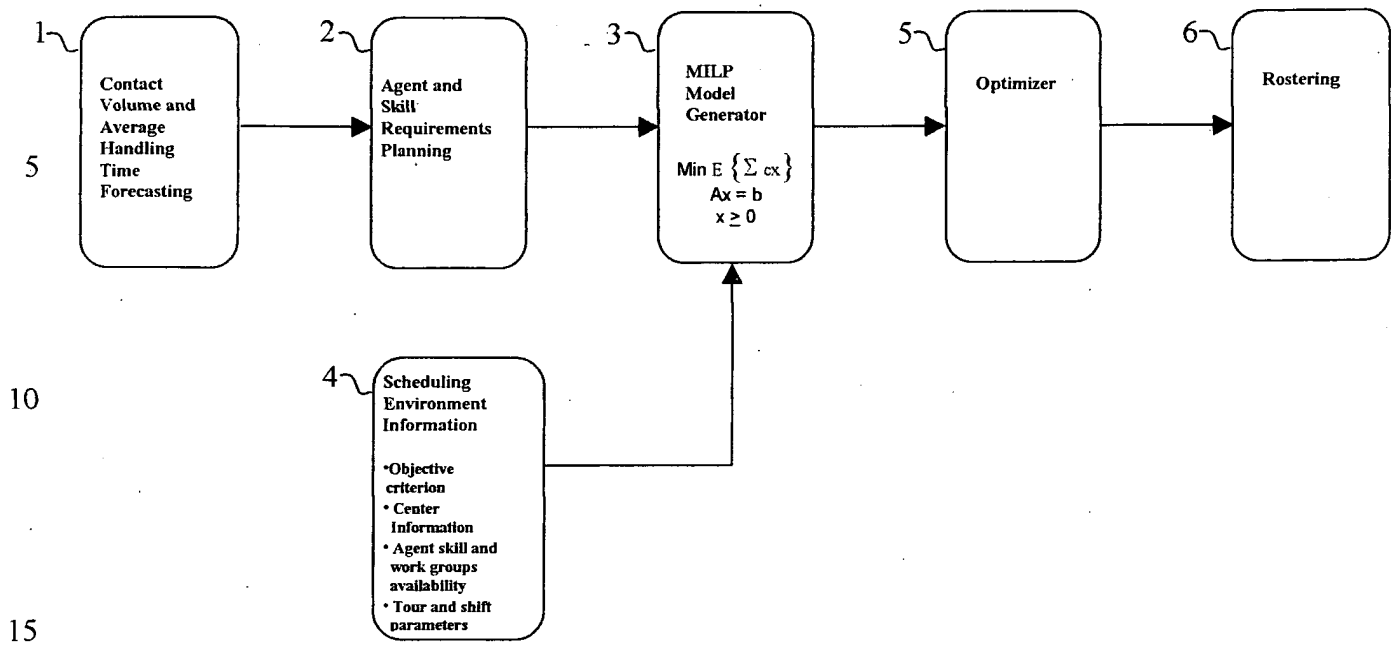
1
Contact Volume and Average Handling Time Forecasting
2
Agent and Skill Requirements Planning
3
MILP Model Generator
Min E $\{\Sigma cx\}$
Ax = b
x ≥ 0
5
Optimizer
6
Rostering
4
Scheduling Environment Information
•Objective criterion
• Center Information
• Agent skill and work groups availability
• Tour and shift parameters

FIG. 1

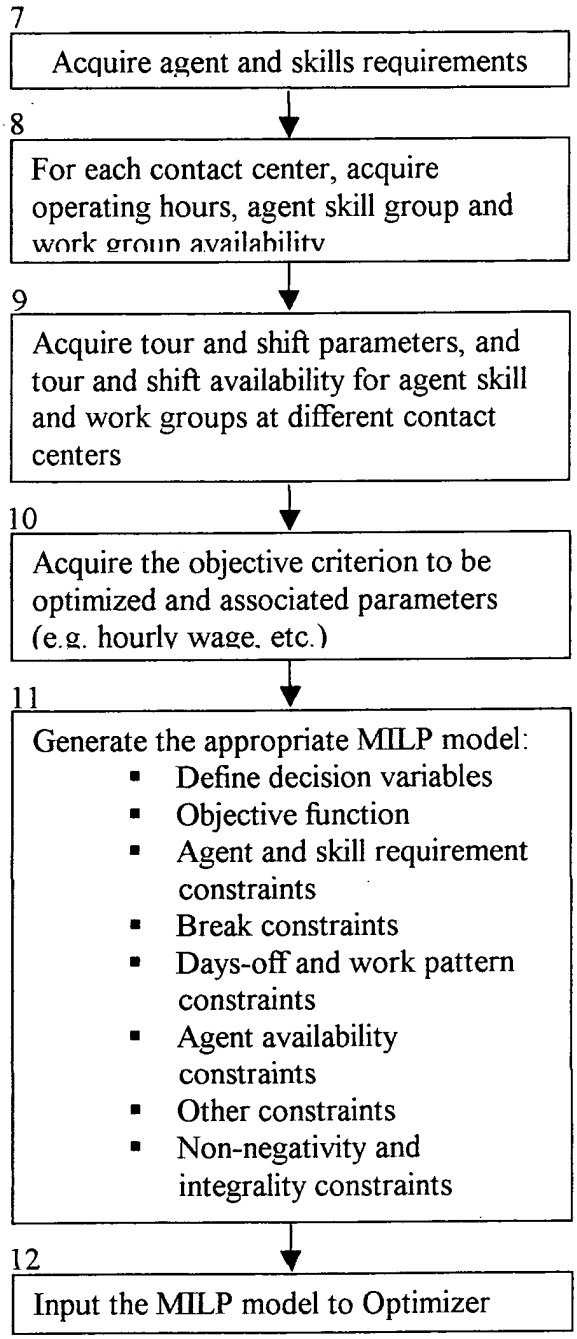
7
Acquire agent and skills requirements
8
For each contact center, acquire operating hours, agent skill group and work group availability
9
Acquire tour and shift parameters, and tour and shift availability for agent skill and work groups at different contact centers
10
Acquire the objective criterion to be optimized and associated parameters (e.g. hourly wage, etc.)
11
Generate the appropriate MILP model:
Define decision variables
Objective function
Agent and skill requirement constraints
Break constraints
Days-off and work pattern constraints
Agent availability constraints
Other constraints
Non-negativity and integrality constraints
12
Input the MILP model to Optimizer

FIG. 2

FIG. 3

13 Number of Days-off	14 Number of Consecutive Days-off	15 1	2	3	4	5	6	7
0	0	1	1	1	1	1	1	1
1	1	0	1	1	1	1	1	1
	1	1	0	1	1	1	1	1
	1	1	1	0	1	1	1	1
	1	1	1	1	0	1	1	1
	1	1	1	1	1	0	1	1
	1	1	1	1	1	1	0	1
	1	1	1	1	1	1	1	0
2	2	0	0	1	1	1	1	1
	2	1	0	0	1	1	1	1
	2	1	1	0	0	1	1	1
	2	1	1	1	0	0	1	1
	2	1	1	1	1	0	0	1
	2	1	1	1	1	1	0	0
	2	0	1	1	1	1	1	0
	1	0	1	0	1	1	1	1
	1	0	1	1	0	1	1	1
	1	0	1	1	1	0	1	1
	1	0	1	1	1	1	0	1
	1	1	0	1	0	1	1	1
	1	1	0	1	1	0	1	1
	1	1	0	1	1	1	0	1
	1	1	0	1	1	1	1	0
	1	1	1	0	1	0	1	1
	1	1	1	0	1	1	0	1
	1	1	1	0	1	1	1	0
	1	1	1	1	0	1	1	0
3	3	0	0	0	1	1	1	1
	3	1	0	0	0	1	1	1
	3	1	1	0	0	0	1	1
	3	1	1	1	0	0	0	1
	3	1	1	1	1	0	0	0
	3	0	1	1	1	1	0	0
	3	0	0	1	1	1	1	0
	2	0	0	1	0	1	1	1
	2	0	0	1	1	0	1	1
	2	0	0	1	1	1	0	1
	2	1	0	0	1	0	1	1
	2	1	0	0	1	1	0	1
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	2	1	1	0	0	1	1	0
	2	0	1	0	0	1	1	1
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	2	1	0	1	0	0	1	1
	2	0	1	1	1	0	0	1
	2	1	0	1	1	0	0	1
	2	1	1	0	1	0	0	1
	2	1	0	1	1	1	0	0
	2	1	1	0	1	1	0	0
	2	1	1	1	0	1	0	0
	2	0	1	0	1	1	1	0
	2	0	1	1	0	1	1	0
	2	0	1	1	1	0	1	0
	1	0	1	0	1	0	1	1
	1	0	1	0	1	1	0	1
	1	0	1	1	0	1	0	1
	1	1	0	1	0	1	0	1
	1	1	0	1	0	1	1	0
	1	1	0	1	1	0	1	0
	1	1	1	0	1	0	1	0
4	4	0	0	0	0	1	1	1
	4	1	0	0	0	0	1	1
	4	1	1	0	0	0	0	1
	4	1	1	1	0	0	0	0
	4	0	1	1	1	0	0	0
	4	0	0	1	1	1	0	0
	4	0	0	0	1	1	1	0
	3	0	0	0	1	0	1	1
	3	0	0	0	1	1	0	1

FIG 3. (Cont'd)

	3	1	0	0	0	1	0	1
	3	1	0	0	0	1	1	0
	3	1	1	0	0	0	1	0
	3	0	1	0	0	0	1	1
	3	0	1	1	0	0	0	1
	3	1	0	1	0	0	0	1
	3	1	0	1	1	0	0	0
	3	1	1	0	1	0	0	0
	3	0	1	0	1	1	0	0
	3	0	1	1	0	1	0	0
	3	0	0	1	0	1	1	0
	3	0	0	1	1	0	1	0
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	2	0	0	1	1	0	0	1
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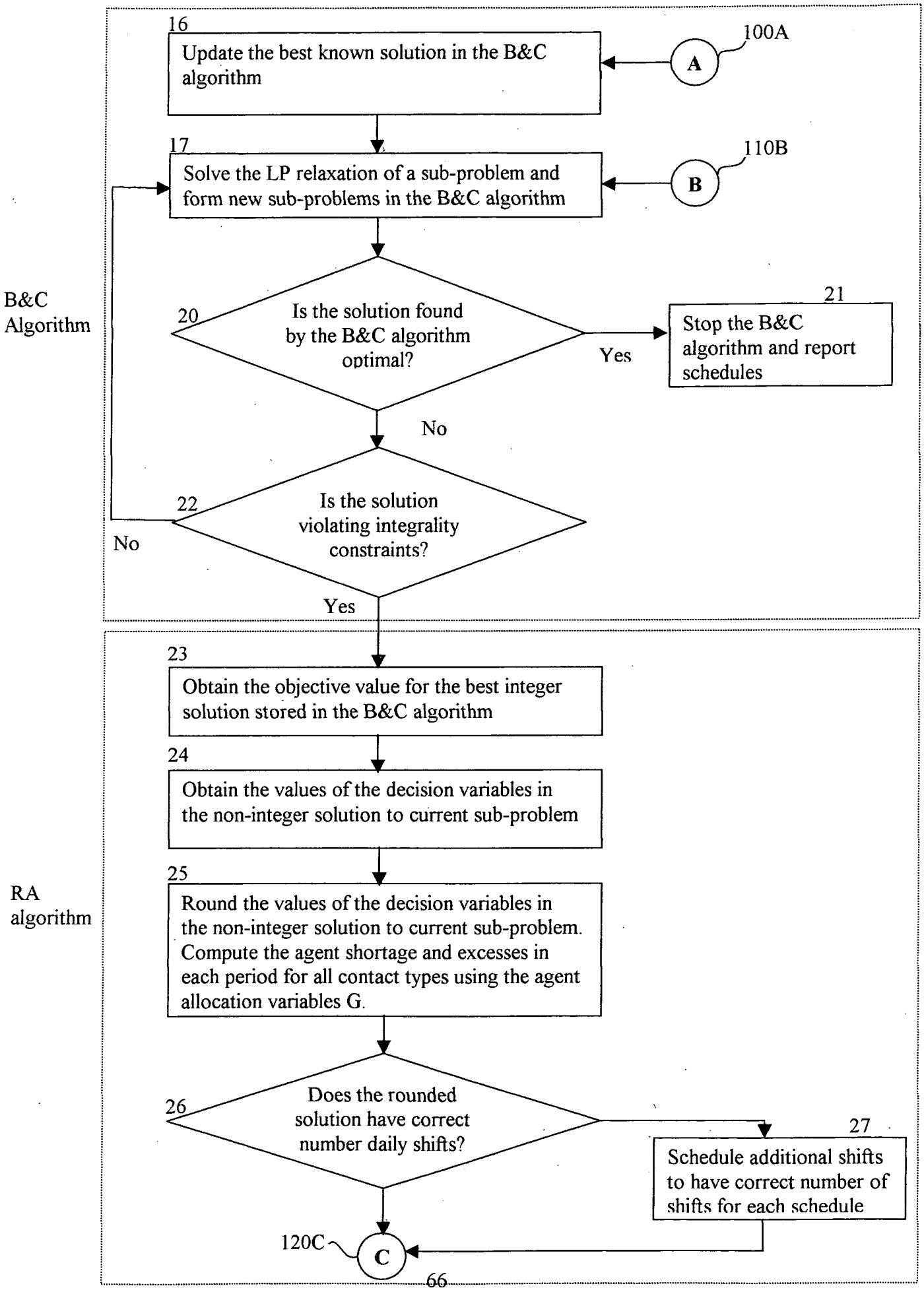
	2	1	1	0	0	1	0	0
	2	0	1	0	0	1	1	0
	2	0	1	1	0	0	1	0
	2	0	0	1	0	1	0	1
	2	1	0	0	1	0	1	0
	2	0	1	0	0	1	0	1
	2	1	0	1	0	0	1	0
	2	0	1	0	1	0	0	1
	2	1	0	1	0	1	0	0
	2	0	1	0	1	0	1	0
5	5	0	0	0	0	0	1	1
	5	1	0	0	0	0	0	1
	5	1	1	0	0	0	0	0
	5	0	1	1	0	0	0	0
	5	0	0	1	1	0	0	0
	5	0	0	0	1	1	0	0
	5	0	0	0	0	1	1	0
	4	0	0	0	0	1	0	1
	4	1	0	0	0	0	1	0
	4	0	1	0	0	0	0	1
	4	1	0	1	0	0	0	0
	4	0	1	0	1	0	0	0
	4	0	0	1	0	1	0	0
	4	0	0	0	1	0	1	0
	3	0	0	0	1	0	0	1
	3	1	0	0	0	1	0	0
	3	0	1	0	0	0	1	0
	3	0	0	1	0	0	0	1
	3	1	0	0	1	0	0	0
	3	0	1	0	0	1	0	0
	3	0	0	1	0	0	1	0
6	6	0	0	0	0	0	0	1
	6	1	0	0	0	0	0	0
	6	0	1	0	0	0	0	0
	6	0	0	1	0	0	0	0
	6	0	0	0	1	0	0	0
	6	0	0	0	0	1	0	0
	6	0	0	0	0	0	1	0
7		0	0	0	0	0	0	0


B&C Algorithm
16
Update the best known solution in the B&C algorithm
100A
A
17
Solve the LP relaxation of a sub-problem and form new sub-problems in the B&C algorithm
110B
B
20
Is the solution found by the B&C algorithm optimal?
Yes
21
Stop the B&C algorithm and report schedules
No
22
Is the solution violating integrality constraints?
No
Yes
RA algorithm
23
Obtain the objective value for the best integer solution stored in the B&C algorithm
24
Obtain the values of the decision variables in the non-integer solution to current sub-problem
25
Round the values of the decision variables in the non-integer solution to current sub-problem. Compute the agent shortage and excesses in each period for all contact types using the agent allocation variables G.
26
Does the rounded solution have correct number daily shifts?
27
Schedule additional shifts to have correct number of shifts for each schedule
120C
C
66

RA algorithm

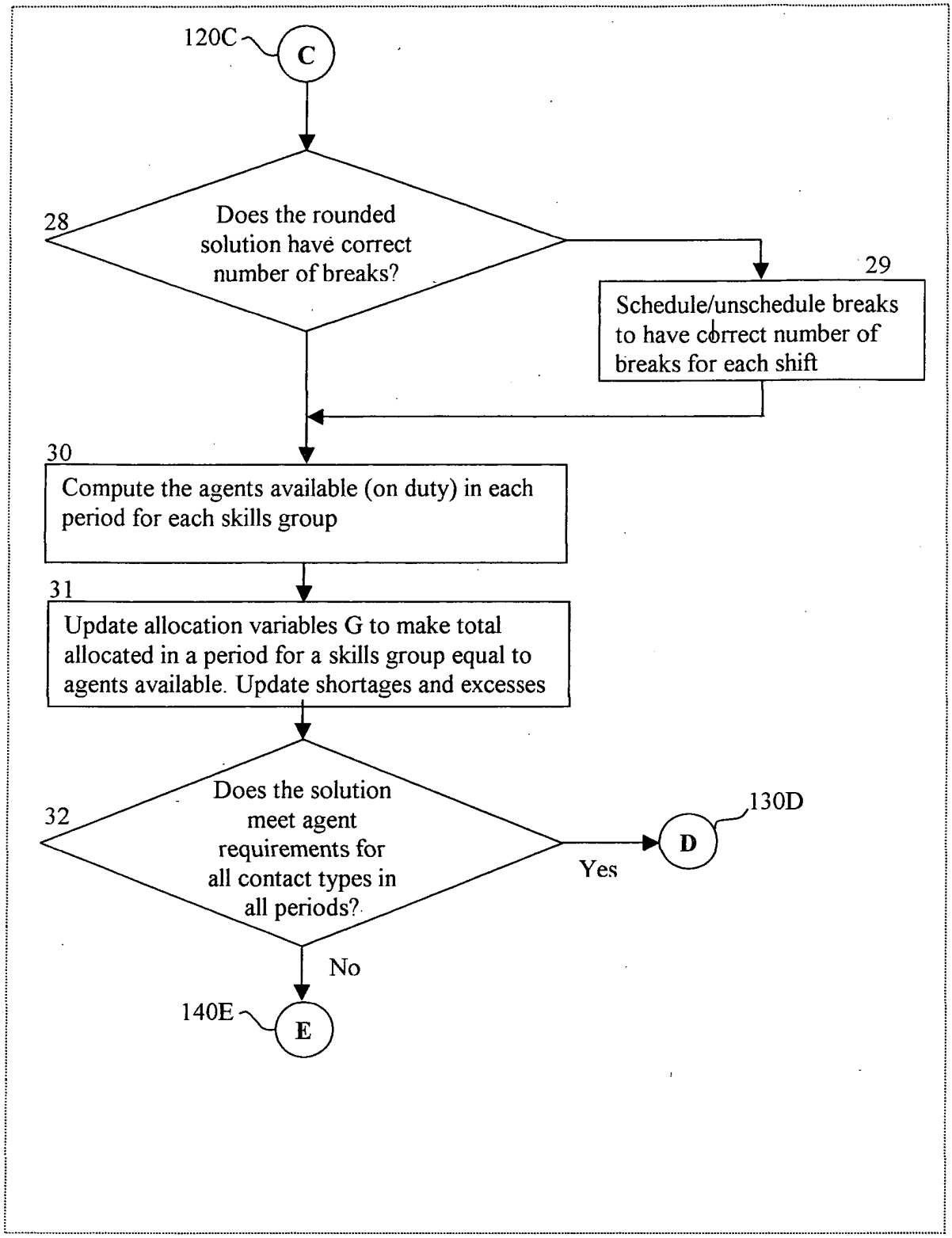


FIG 4.

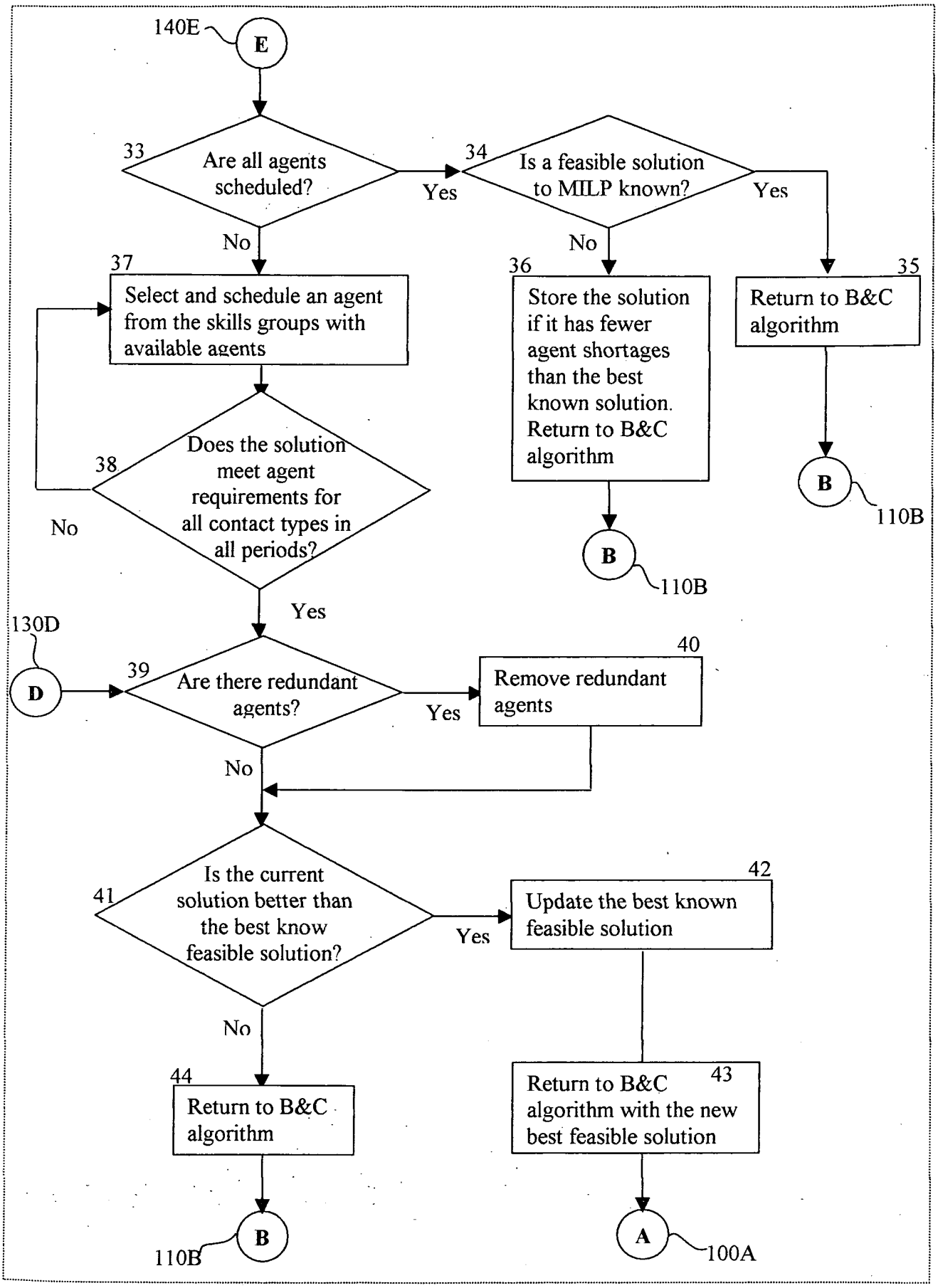

140E
E
33
Are all agents scheduled?
Yes
34
Is a feasible solution to MILP known?
Yes
No
No
37
Select and schedule an agent from the skills groups with available agents
36
Store the solution if it has fewer agent shortages than the best known solution. Return to B&C algorithm
35
Return to B&C algorithm
B
110B
38
Does the solution meet agent requirements for all contact types in all periods?
No
B
110B
Yes
130D
D
39
Are there redundant agents?
Yes
40
Remove redundant agents
No
41
Is the current solution better than the best know feasible solution?
Yes
42
Update the best known feasible solution
No
44
Return to B&C algorithm
43
Return to B&C algorithm with the new best feasible solution
B
110B
A
100A

FIG 4.